

REMARKS/ARGUMENTS

The Applicants have carefully considered this application in connection with the Examiner's Action and respectfully request reconsideration of this application in view of the foregoing amendment and the following remarks.

The Applicants originally submitted Claims 1-33 in the application. In a previous response to an Election requirement, the Applicants elected Claims 1-11 and 23-33, consisting of Group I. Presently, the Applicants have amended Claims 1 and 23, and have canceled Claims 5, 7-10, 12-22, 24 and 26-30. The Applicants have not amended, canceled nor added any other claims. Accordingly, Claims 1-4, 6, 11, 23, 25, and 31-33 are currently pending in the application.

I. Rejection of Claims 1-2, 5-6, and 11 under 35 U.S.C. §102

The Examiner has rejected Claims 1-2, 5-6 and 11 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,291,282 to Wilk, *et al.* ("Wilk"). Independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. Wilk fails to disclose this element.

Wilk is directed to a method for forming dual metal gate structures or CMOS devices. (Title). Wilk teaches that a conductor **326** may be formed over a substrate **301**. Wilk further teaches that prior to the patterning and etching of conductor **326** and insulating layer **324** or after this step, one portion (or one of the gate conductors--conductor **327**) is altered so as to change its work function. This can be accomplished by masking off the portion of conductor **326** (or conductor

329) and subjecting the exposed portion of conductor **326** or conductor **327** to the altering agent. Wilk teaches that this alteration may occur by subjecting the wafer to a nitrogen gas (preferably N_2), which is incorporated in a plasma. Wilk discloses that the goal of this step is to substantially completely convert the Ta, Mo or Ti into Ta_xN_y , Mo_xN_y , or Ti_xN_y . (See Wilk at column 5, lines 3-42). Notwithstanding, Wilk fails to disclose the claimed element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function.

Therefore, Wilk does not disclose each and every element of the claimed invention and as such, is not an anticipating reference. Because Claims 2, 5-6 and 11 are dependent upon Claim 1, Wilk also cannot be an anticipating reference for Claims 2, 5-6 and 11. Accordingly, the Applicants respectfully request the Examiner to withdraw the §102 rejection with respect to these Claims.

II. Rejection of Claims 1-6 and 11 under 35 U.S.C. §102

The Examiner has rejected Claims 1-6 and 11 under 35 U.S.C. §102(b) as being anticipated by U.S. Publication No. 2002/0195679 to Hu ("Hu"). Independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. Hu fails to disclose this element.

Hu is directed to metal gate engineering for surface p-channel devices. (Title). Hu teaches that a photoresist layer **110** is applied over PMOS regions **112** in a known manner so as to selectively mask the PMOS regions **112**. Hu also teaches that unmasked NMOS regions **114** are

implanted with nitrogen (N) **116**. In this embodiment, Hu discloses that the nitrogen implantation **116** comprises an implant of nitrogen of 3×10^{15} at 5 keV. In another embodiment, Hu discloses that the nitrogen implantation **116** is done to similar parameters with a plasma anneal in a known manner. (See Hu at paragraph [0026]). Notwithstanding, Hu fails to disclose the claimed element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function.

Therefore, Hu does not disclose each and every element of the claimed invention and as such, is not an anticipating reference. Because Claims 2-6 and 11 are dependent upon Claim 1, Hu also cannot be an anticipating reference for Claims 2-6 and 11. Accordingly, the Applicants respectfully request the Examiner to withdraw the §102 rejection with respect to these Claims.

III. Rejection of Claims 1-4 and 9-10 under 35 U.S.C. §102

The Examiner has rejected Claims 1-4 and 9-10 under 35 U.S.C. §102(b) as being anticipated by U.S. Publication No. 2003/0062577 to Rotondaro, *et al.* ("Rotondaro"). Independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. Rotondaro fails to disclose this element.

Rotondaro is directed to a method and system for forming dual work function gate electrodes in a semiconductor device. (Title). Rotondaro teaches that a metal layer **40** may be

formed over a dielectric layer **30**. Rotondaro further teaches that a silicon-germanium layer **50** may be formed over the metal layer **40**. Rotondaro discloses that the silicon-germanium layer **50** is a conformal layer that may be deposited by any suitable means, preferably ensuring little or no reaction between the silicon-germanium layer **50** and the metal layer **40**. For example, a plasma-enhanced chemical vapor deposition, which may be carried out at relatively low temperatures, may be used. (See Rotondaro at paragraphs [0016] thru [0018]). Rotondaro then teaches that the silicon-germanium layer **50** is patterned to remain over a certain regions (e.g., the NMOS regions **14**), and then annealed to reduce the work function of the regions that it was located over.

Notwithstanding, Rotondaro fails to disclose the claimed element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. First, Rotondaro fails to teach a plasma silicidation or plasma germanidation process, but teaches depositing a silicon germanium layer using a plasma-enhanced chemical vapor deposition (CVD) process. Second, it is not the deposition of the silicon germanium layer using the plasma enhanced CVD process of Rotondaro that changes its work function, but it is the subsequent anneal of the already deposited silicon germanium layer that changes the work function of Rotondaro. For these two reasons, among others, Rotondaro fails to disclose this claimed element.

Therefore, Rotondaro does not disclose each and every element of the claimed invention and as such, is not an anticipating reference. Because Claims 2-4 and 9-10 are dependent upon Claim 1, Rotondaro also cannot be an anticipating reference for Claims 2-4 and 9-10. Accordingly,

the Applicants respectfully request the Examiner to withdraw the §102 rejection with respect to these Claims.

IV. Rejection of Claims 1-2, 6-8 and 11 under 35 U.S.C. §102

The Examiner has rejected Claims 1-2, 6-8 and 11 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,890,807 to Chau, *et al.* ("Chau"). Independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. Chau fails to disclose this element.

Chau is directed to a method for making a semiconductor device having a metal gate electrode. (Title). Chau teaches that after forming metal layer **202** on dielectric layer **201**, portion **210** of metal layer **202** is masked, e.g., by photoresist **215**. Chau further teaches that after masking portion **210**, impurities are added to exposed portion **211** of metal layer **202**. (See Chau at column 5, lines 10-50). Chau discloses that the impurities may be added by ion implantation, plasma enhanced ion implantation, furnace diffusion, and plasma deposition. (See Chau at column 4, lines 35-40). Notwithstanding, Chau fails to disclose the claimed element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function.

Therefore, Chau does not disclose each and every element of the claimed invention and as such, is not an anticipating reference. Because Claims 2, 6-8 and 11 are dependent upon Claim 1,

Chau also cannot be an anticipating reference for Claims 2, 6-8 and 11. Accordingly, the Applicants respectfully request the Examiner to withdraw the §102 rejection with respect to these Claims.

V. Rejection of Claims 23-25 and 31 under 35 U.S.C. §103

The Examiner has rejected Claims 23-25 and 31 under 35 U.S.C. §103(a) as being unpatentable over Wilk in view of U.S. Patent No. 6,133,079 to Zhu, *et al.* ("Zhu"). As was previously indicated, independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. As was previously established, Wilk fails to disclose this element. Wilk further fails to suggest this element. Wilk fails to suggest such an element because Wilk is specifically directed to plasma nitridation, and not plasma silicidation or plasma germanidation, as is claimed. Accordingly, Wilk fails to teach or suggest the aforementioned claimed element.

Zhu fails to correct the deficiencies of Wilk. The Examiner is offering Zhu for the sole proposition that interconnects can be located within dielectric layers over the transistors. Notwithstanding the accuracy of the Examiner's assertions, a teaching that interconnects can be located within dielectric layers over the transistors, is very different from a teaching of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function, as is presently claimed. Accordingly, Zhu also fails to teach or suggest the aforementioned claimed element.

Thus, Wilk, individually or in combination with Zhu, fails to teach or suggest the invention recited in independent Claims 1, 23 and their dependent claims, when considered as a whole. Accordingly, the combination must fail to establish a prima facie case of obviousness with respect to these claims. Claims 23-35 and 31 are therefore not obvious in view of this combination.

In view of the foregoing remarks, the cited references do not support the Examiner's rejection of Claims 23-35 and 31 under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection.

VI. Rejection of Claims 23-25 and 31-33 under 35 U.S.C. §103

The Examiner has rejected Claims 23-25 and 31-33 under 35 U.S.C. §103(a) as being unpatentable over Hu in view of Zhu. As was previously indicated, independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. As was previously established, Hu fails to disclose this element. Hu further fails to suggest this element. Hu fails to suggest such an element because Hu is specifically directed to plasma nitridation, and not plasma silicidation or plasma germanidation, as is claimed. Accordingly, Hu fails to teach or suggest the aforementioned claimed element. It was also previously established that Zhu fails to teach or suggest such an element.

Thus, Hu, individually or in combination with Zhu, fails to teach or suggest the invention recited in independent Claims 1, 23 and their dependent claims, when considered as a whole.

Accordingly, the combination must fail to establish a prima facie case of obviousness with respect to these claims. Claims 23-35 and 31-33 are therefore not obvious in view of this combination.

In view of the foregoing remarks, the cited references do not support the Examiner's rejection of Claims 23-35 and 31-33 under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection.

VII. Rejection of Claims 23, 28-30 and 32-33 under 35 U.S.C. §103

The Examiner has rejected Claims 23, 28-30 and 32-33 under 35 U.S.C. §103(a) as being unpatentable over Rotondaro in view of Zhu. As was previously indicated, independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. As was previously established, Rotondaro fails to disclose this element. Rotondaro further fails to suggest this element. Rotondaro fails to suggest such an element because Rotondaro fails to suggest a single plasma process that changes a material's work function, let alone a plasma silicidation or plasma germanidation that changes a material's work function. Accordingly, Rotondaro fails to teach or suggest the aforementioned claimed element. It was also previously established that Zhu fails to teach or suggest such an element.

Thus, Rotondaro, individually or in combination with Zhu, fails to teach or suggest the invention recited in independent Claims 1, 23 and their dependent claims, when considered as a whole. Accordingly, the combination must fail to establish a prima facie case of obviousness with

respect to these claims. Claims 23, 28-30 and 32-33 are therefore not obvious in view of this combination.

In view of the foregoing remarks, the cited references do not support the Examiner's rejection of Claims 23, 28-30 and 32-33 under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection.

VIII. Rejection of Claims 23, 25-27 and 31 under 35 U.S.C. §103

The Examiner has rejected Claims 23, 25-27 and 31 under 35 U.S.C. §103(a) as being unpatentable over Chau in view of Zhu. As was previously indicated, independent Claims 1 and 23 currently include the element of subjecting at least a portion of the metal gate electrode material to at least one of a plasma silicidation or plasma germanidation process, the plasma process causing the portion to have a different work function. As was previously established, Chau fails to disclose this element. Chau further fails to suggest this element. Chau fails to suggest such an element because Chau is specifically directed to plasma nitridation, and not plasma silicidation or plasma germanidation, as is claimed. Accordingly, Chau fails to teach or suggest the aforementioned claimed element. It was also previously established that Zhu fails to teach or suggest such an element.

Thus, Chau, individually or in combination with Zhu, fails to teach or suggest the invention recited in independent Claims 1, 23 and their dependent claims, when considered as a whole. Accordingly, the combination must fail to establish a prima facie case of obviousness with

respect to these claims. Claims 23, 25-27 and 31 are therefore not obvious in view of this combination.

In view of the foregoing remarks, the cited references do not support the Examiner's rejection of Claims 23, 25-27 and 31 under 35 U.S.C. §103(a). The Applicants therefore respectfully request the Examiner withdraw the rejection.

IX. Prior Art Made of Record

The Applicants believe that the prior art made of record and not relied upon by the Examiner is not particularly pertinent to the claimed invention, but the Applicants retain the right to address these references in detail, if necessary, in the future.

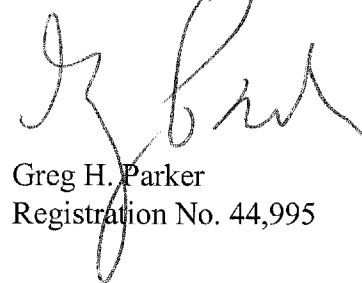
X. Conclusion

In view of the foregoing amendment and remarks, the Applicants now see all of the Claims currently pending in this application to be in condition for allowance and therefore earnestly solicit a Notice of Allowance for Claims 1-4, 6, 11, 23, 25, and 31-33.

The Applicants request the Examiner to telephone the undersigned attorney of record at (972) 480-8800 if such would further or expedite the prosecution of the present application. The Commissioner is hereby authorized to charge any fees, credits or overpayments to Deposit Account 20-0668.

Respectfully submitted,

HITT GAINES, PC

A handwritten signature in black ink, appearing to read "Greg H. Parker", is written over the printed name and registration number.

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